

09505516-021700

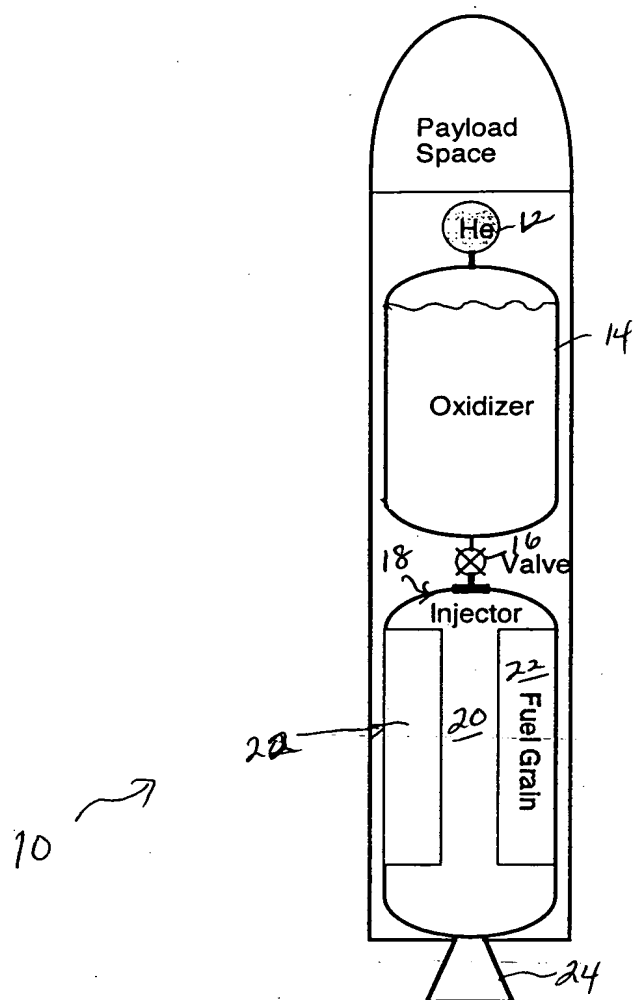


Figure 1: Schematic of a hybrid rocket utilizing a blow-down oxidizer feed system.

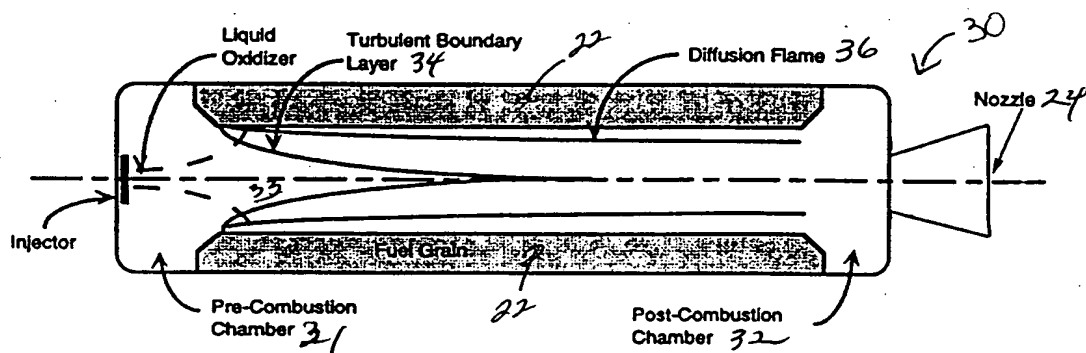


Figure 2. Schematic of a single port hybrid rocket motor.

A schematic diagram of a burning fuel grain. The grain is shown in cross-section, with a central cavity. The grain is divided into three main regions: a top 'Liquid Layer' (hatched), a middle 'Gas' region (stippled), and a bottom 'Fuel Grain' (solid). A horizontal line represents the 'Interface' between the liquid and gas. Above the interface, a horizontal arrow indicates gas flow with parameters $\rho_g u_g$ and T_g, P_g . The interface velocity is labeled $U_{\text{interface}}$. The flame is shown as a curved line above the interface, with temperatures T_{flame} and $T_{\text{interface}}$ indicated. The grain is surrounded by an environment at temperature T_a . A vertical arrow labeled r points downwards from the top surface of the grain.

Figure 4: Schematic of velocity and temperature profiles in a liquefying hybrid rocket.

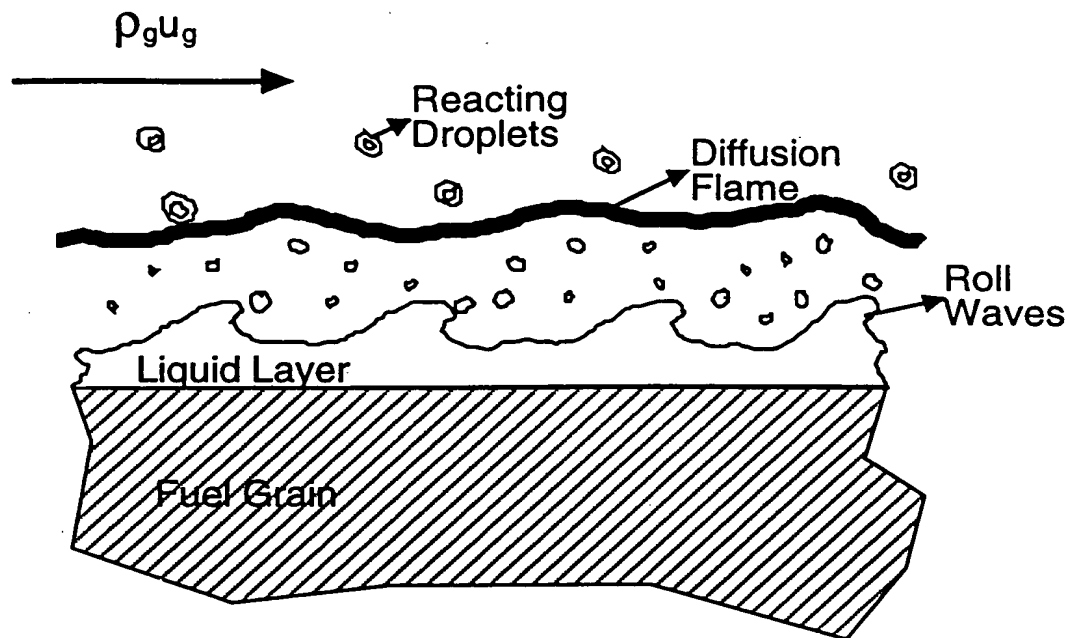


Figure 5: Schematic of the entraining hybrid combustion configuration.

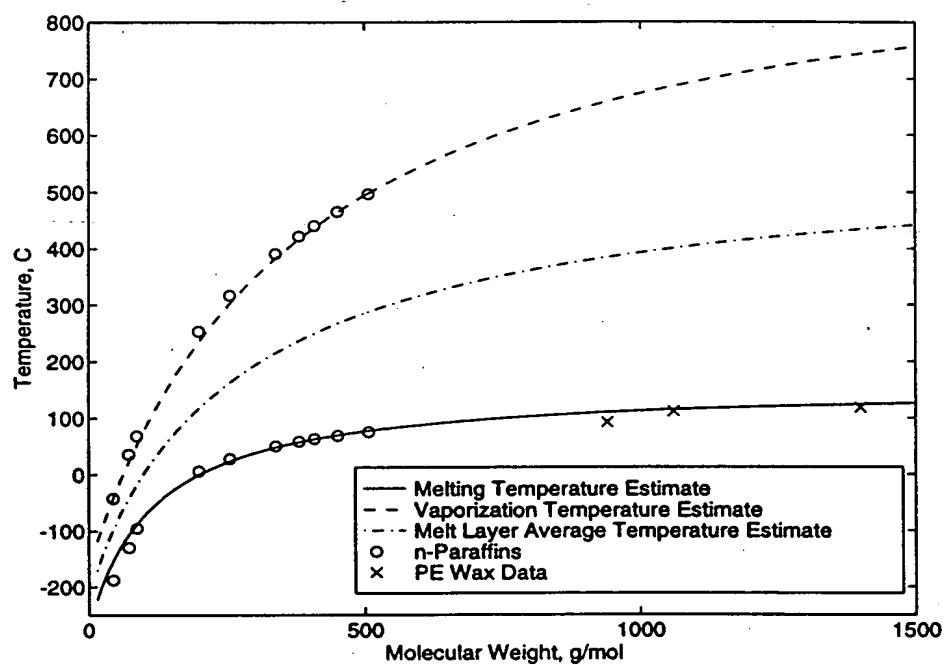


Figure 6. Melting, vaporization and average melt layer temperatures of n-paraffins as a function of molecular weight.

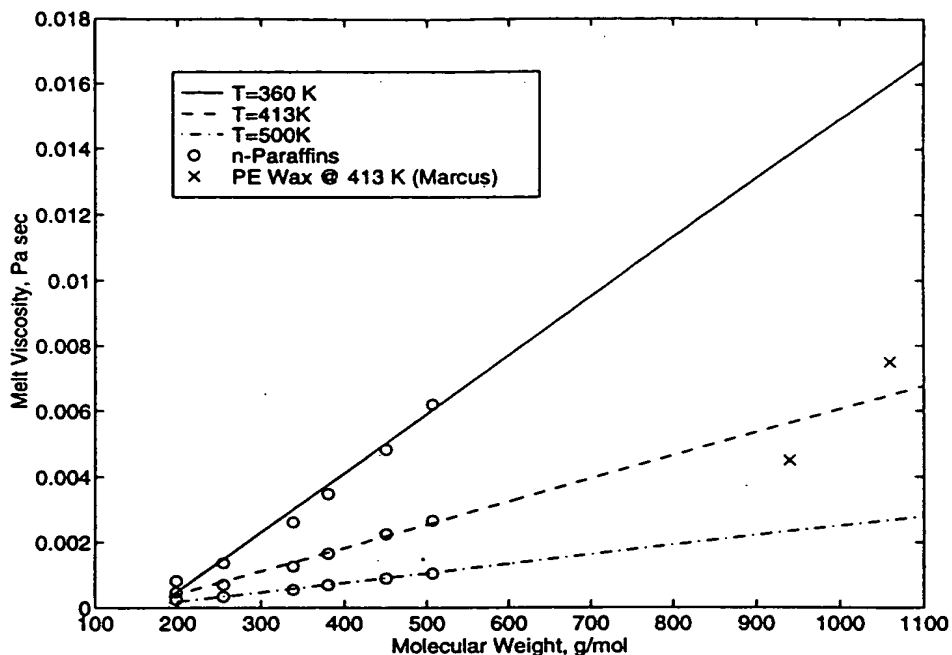


Figure 7. Viscosity as a function of the molecular weight for various n-paraffins and two highly crystalline polyethylene waxes.

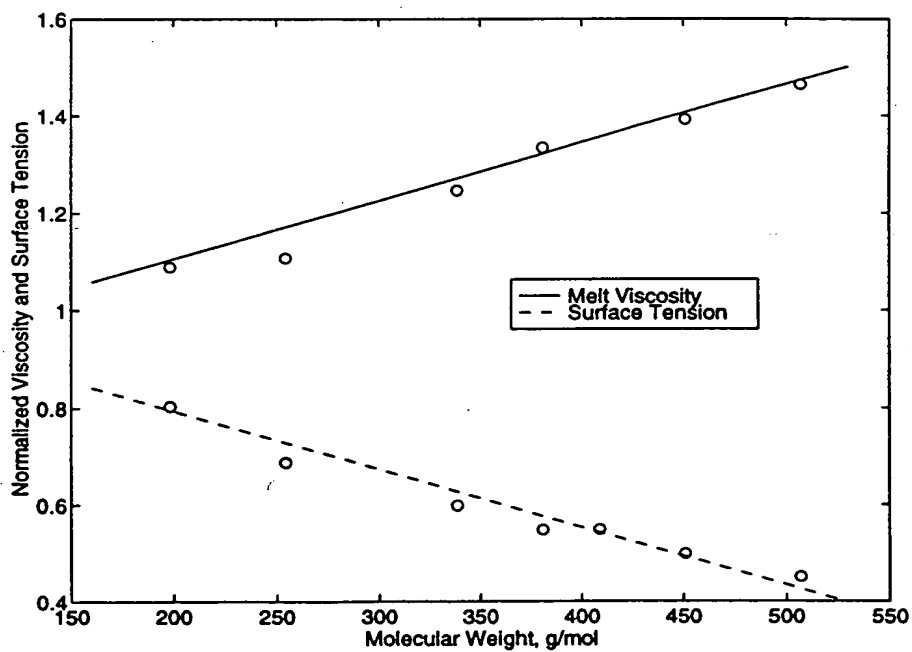


Figure 8. Viscosity and surface tension of the melt layer as a function of the molecular weight for various n-paraffins. The values of viscosity and surface tension are normalized with respect to the reference values (n-pentane).

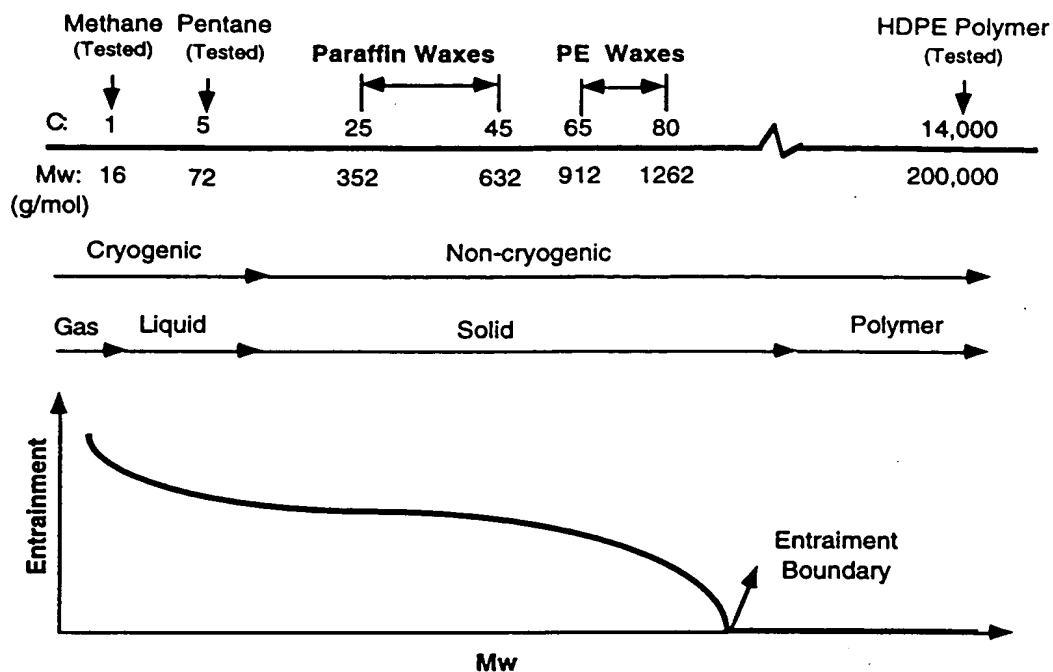


Figure 9. Overall picture for C_nH_{2n+2} series.

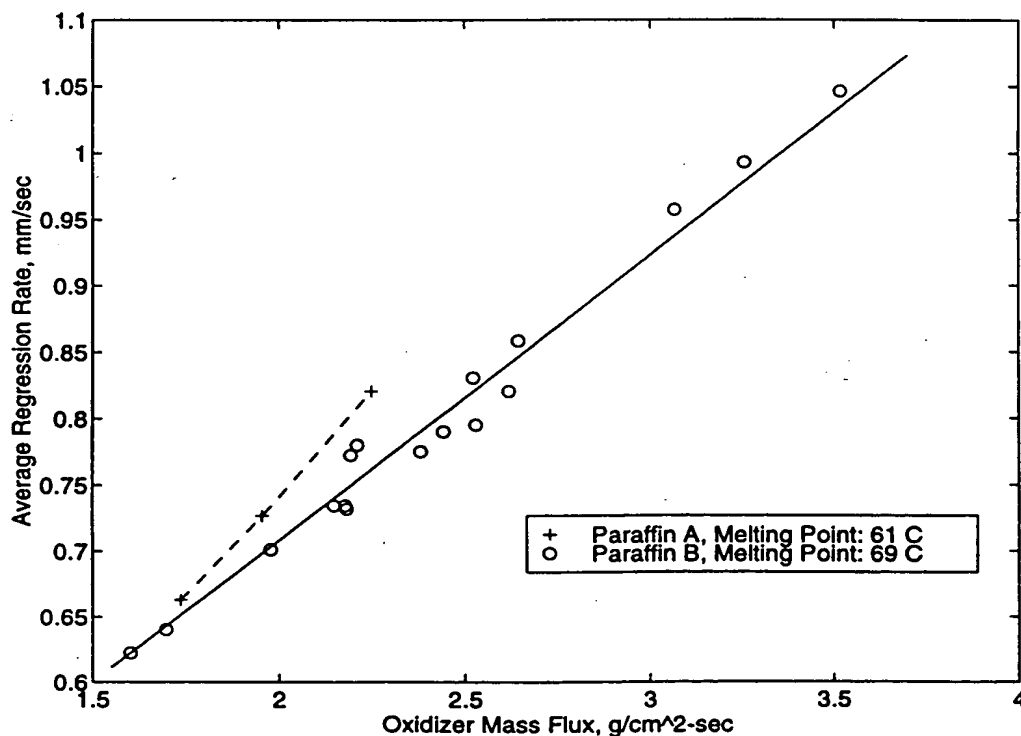


Figure 10: Measured regression rates as a function of oxidizer mass flux for paraffins A and B.

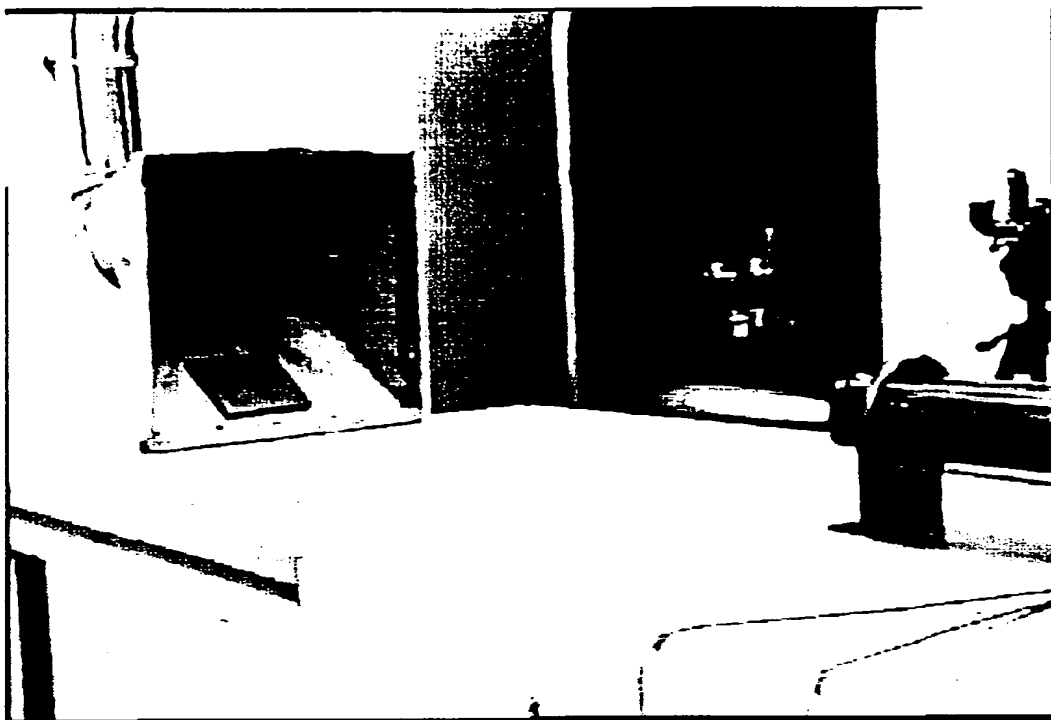


Figure 11a: Picture of the plume for the PMMA/GOX system.

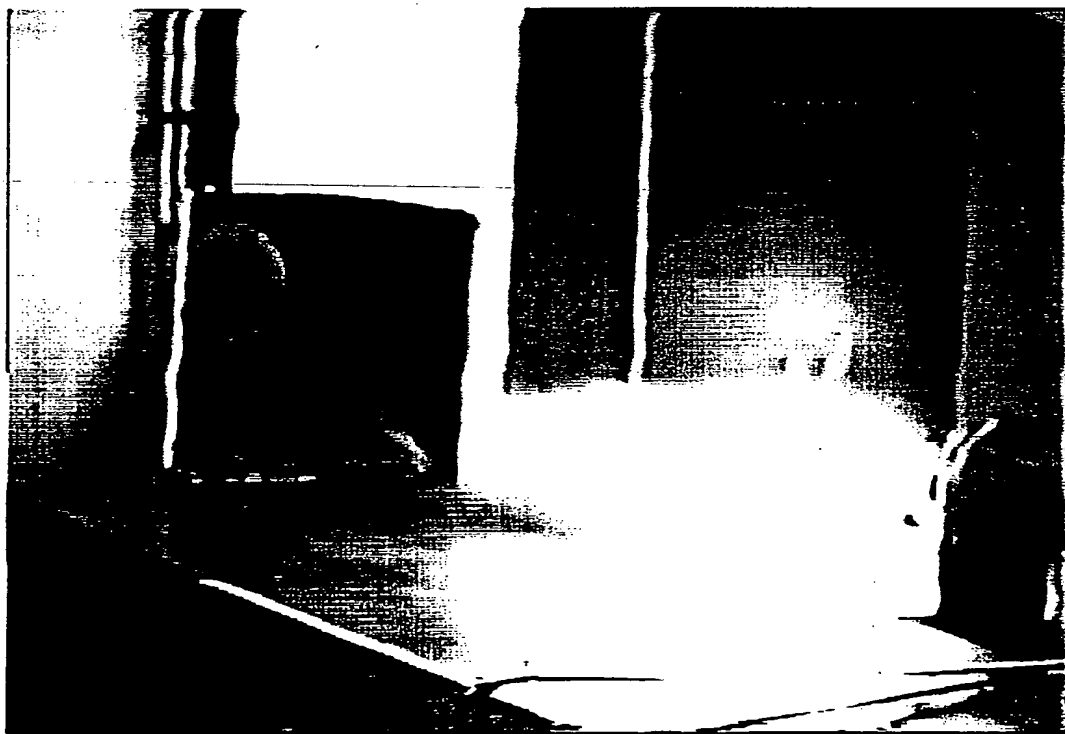


Figure 11b: Picture of the plume for the paraffin wax (grade B)/GOX system.

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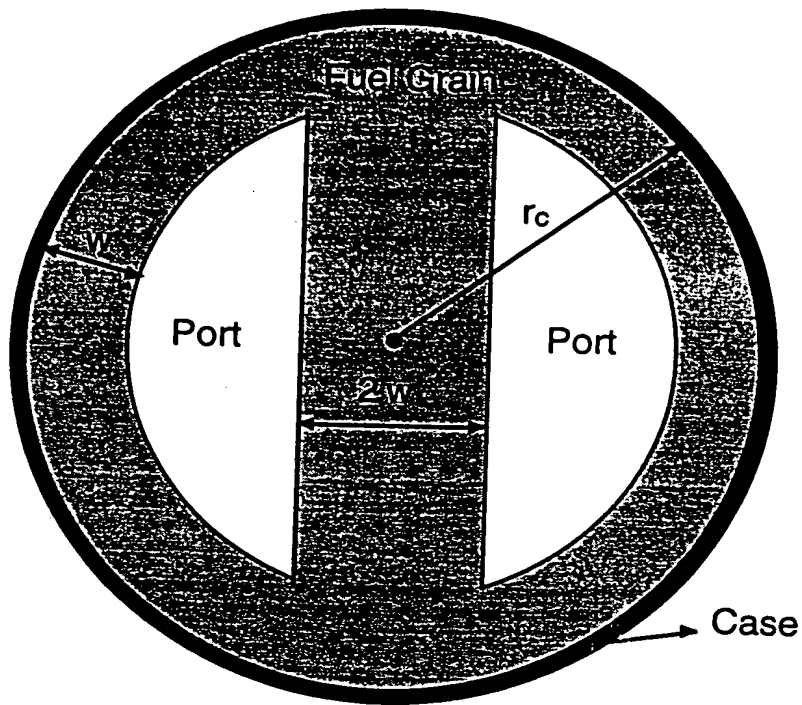


Figure 12a: Schematic of a Double-D hybrid port configuration

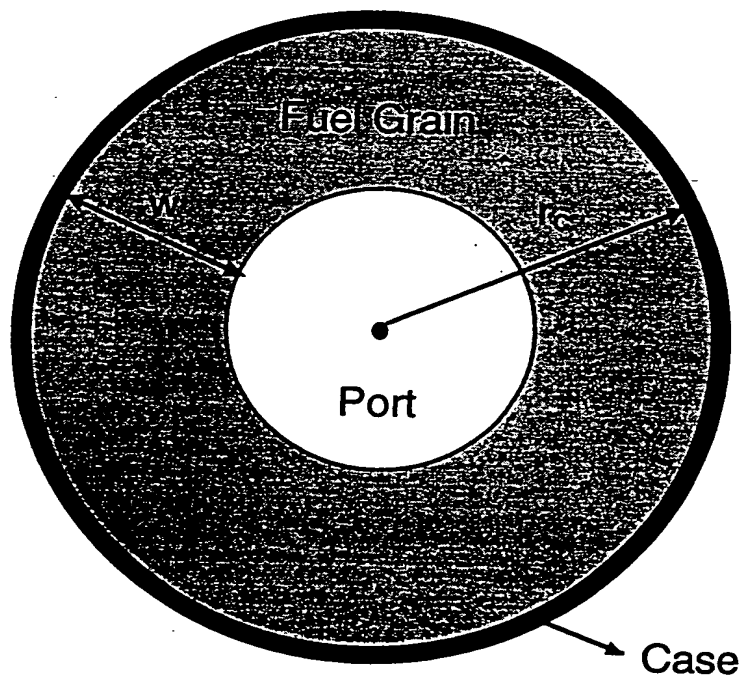


Figure 12b: Schematic of a circular (single port) hybrid port configuration

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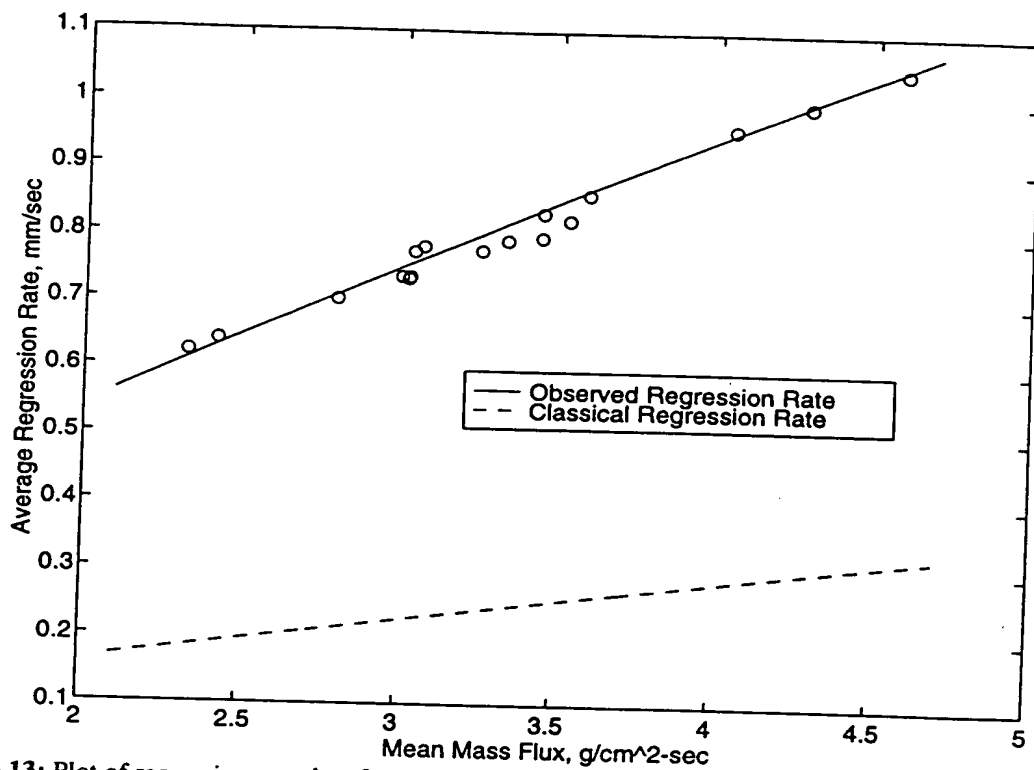


Figure 13: Plot of regression rate data for paraffin wax B and the estimated classical regression rate.

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